

# A Diary Study on Work-Related Smartphone Use, Psychological Detachment and Exhaustion: Examining the Role of the Perceived Segmentation Norm

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In this diary study, we examined the associations between daily work-related smartphone use and daily psychological detachment and daily work-related exhaustion within a group of smartphone owners. In addition, we studied the role of the perceived segmentation norm at the workplace as a moderator of the link between work-related smartphone use and detachment. A total of 70 employees using smartphones on initiative of their employer completed a diary questionnaire on 4 successive workdays ( $N = 268$  data points). We hypothesized that work-related smartphone use is negatively related to psychological detachment and that psychological detachment, in turn, is negatively related to work-related exhaustion. Finally, we expected that especially employees who perceive a high segmentation norm at their workplace have difficulties to psychologically detach from work on days that they use their smartphone more intensively. Overall, the results of multilevel analyses supported these hypotheses. The findings emphasize the importance of a clear organizational policy regarding work-related smartphone use outside of work hours.

**Keywords:** diary study, smartphone, psychological detachment, exhaustion, segmentation

Wireless access to the Internet facilitated by smartphones has changed when, where, and how many hours employees work (Boswell & Olson-Buchanan, 2007; Challenger, 2004). Work in our modern society involves connectivity, immediacy, and a blurring of boundaries between work and nonwork domains (e.g., Mazmanian, Orlikowski, & Yates, 2006; Tomlinson, 2007). In response to organizations' increasing expectations regarding availability, employees increasingly feel compelled to respond immediately to work-related messages, even during evening hours, weekends, and holidays (Davis, 2002). In line with this, Diaz, Chiaburu, Zimmerman, and Boswell (2012) argue that the flexibility to stay connected to work by communication technologies during the day is extended to the evening hours. Some researchers even refer to communication technologies as an "electronic leash," tying employees to their work and making psychological detachment almost impossible (Boswell & Olson-Buchanan, 2007; Olson-Buchanan & Boswell, 2004). In other words, facilitated by these advanced information technologies, employees seem to comply massively with company expectations to work longer hours (Fenner & Renn, 2010). As demonstrated by Madden and Jones (2008), many employees feel that the use of information technology adds flexibility, while at the same time making it increasingly difficult for them to disconnect themselves from work when being away from their workplace.

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In a high impact study, Nippert-Eng (1996) showed that boundary theory can provide a lens for understanding the interaction between work and home domains. Boundary theory (Ashforth, Kreiner, & Fugate, 2000) focuses on the ways in which people create and maintain boundaries in order to simplify and classify the world around them. In this respect, the extent to which organizations promote and support clear work-home boundaries is an important factor. Kreiner, Hollensbe, and Sheep (2006) showed that workplaces vary in the degree to which they treat the boundaries between work and home as (im)permeable. In some workplaces, it may be the norm to freely contact each other after working hours to address work-related issues, whereas initiating work-related contact after work may be considered very undesirable in other workplaces (Park, Fritz, & Jex, 2011). In the terminology of Kreiner (2006), the former type of workplace represents an environment with strong norms to be available for work, which Kreiner referred to as low on segmentation (or high on integration), and the latter type of workplace would be characterized as an environment with impermeable boundaries, which Kreiner labeled as high on segmentation. Park, Fritz, and Jex, 2011, for example, showed that perceptions of a strong segmentation norm were positively associated with psychological detachment, suggesting that workplace norms in favor of segmentation can help employees detach from work demands. The ability to distance oneself from work mentally is important to stay healthy and vigorous (Sonnentag & Kruel, 2006). To our knowledge, however, to date, no quantitative studies on psychological detachment and boundaries between work and private domains have addressed the link with information technologies in general and work-related smartphone use after working hours in particular.

Therefore, in the current study, we examine the associations between work-related smartphone use, psychological detachment,

and work-related exhaustion on a daily basis by conducting a diary study, following employees over four consecutive workdays. First, we will examine the proposition that work-related smartphone use after working hours obstructs psychological detachment from work, thereby increasing employees' work-related exhaustion. Second, we examine *perceived workplace segmentation norm* as a potential moderator of the link between work-related smartphone use after working hours and psychological detachment from work. Workplaces vary in the degree to which they create an environment that promotes either segmentation or integration. Technologies such as smartphones and telecommuting can force at least some integration (Kreiner, 2006). The concept of *perceived segmentation norms* refers to the conditions and resources supplied by organizations that enable a certain level of separation or integration. Figure 1 displays the conceptual model for our study. Our article contributes to the literature on both boundary theory and recovery by examining the cross-level interaction between the perceived segmentation norm at the workplace and daily use of communication technology (i.e., smartphones) on daily psychological detachment. Sonnentag and Bayer (2005) already stressed that daily psychological detachment is important after stressful and demanding days. However, as Sonnentag, Binnewies, and Mojza (2010) note, knowledge about the factors that enable or hinder this process is still very limited. With the current study, we aim to gain more insight into these processes on a daily basis.

### Psychological Detachment

Sonnentag and Bayer (2005) argued that psychological detachment implies that an individual distances oneself from the job in both a physical and a mental sense. Psychological detachment is considered a core component of recovery (Etzion, Eden, & Lapidot, 1998). Lack of psychological detachment outside of work hours implies a continued preoccupation with work-related issues, which impedes the recovery process (Meijman & Mulder, 1998). Furthermore, work stressors remain mentally present, with an increase of negative activation and fatigue as a consequence (Watson, 1988).

Psychological detachment implies that one is not occupied by work-related issues. We argue that the simple fact that a company-provided smartphone is present in the home domain contributes to making work salient outside of work hours, thus obstructing psychological detachment. *Smartphone use* reflects how intensive employees use their smartphone and their tendency to stay online and check for new messages. To achieve psychological detachment it is necessary to stop thinking and ruminating about work.

Receiving work-related messages while being at home will make psychological detachment very difficult, if not impossible. The availability of a smartphone not only increases actual work at home, but also makes work-related issues salient when at home (Sonnentag & Kruel, 2006). In addition, in their diary study, Derkx, ten Brummelhuis, Zecic, and Bakker (2012) showed that intensive smartphone users experience difficulties initiating activities aimed at psychological detachment during evening hours.

Employees need evening hours to detach from work in order to cope with stress properly so that psychological detachment is particularly important after stressful and demanding working days (Sonnentag, 2001; Sonnentag & Bayer, 2005). Paradoxically, however, on these days individuals might be especially inclined to continue working at home (Taris, Beckers, Dahlgren, Geurts, & Tucker, 2007), because job stressors and high strain situations make it difficult to psychologically detach outside of work hours (e.g., Grebner, Semmer, & Elfering, 2005; Sonnentag & Bayer, 2005). When employees stay connected with work while at home, it is likely that the stressor prolongs or reoccurs outside of work hours, placing demands on the same psycho-physiological systems that were already activated during normal working hours (Geurts & Sonnentag, 2006). In all, we propose that intensive work-related smartphone use during the evening with its implicit, or at times explicit, request for 24/7 availability disturbs the important process of disengaging from work.

*Hypothesis 1:* Daily work-related smartphone use will be negatively related to daily psychological detachment.

### From Lack of Psychological Detachment to Work-Related Exhaustion

Psychological detachment from work outside of work hours is a precondition for recovery to occur (Etzion et al., 1998; Sonnentag & Bayer, 2005). When employees are able to mentally switch off from work-related matters, their well-being benefits (Sonnentag & Kruel, 2006). In a diary study, Sonnentag and Bayer (2005) showed that psychological detachment from work outside of work hours was related to less fatigue and a better mood at bedtime.

The increased productivity associated with staying connected to work in the evening hours is often achieved at the cost of mental health, yielding higher stress levels which may lead to poor recovery, impaired performance (Binnewies, Sonnentag & Mojza, 2009), fatigue, and sleep complaints (Van Hooff, Geurts, Kompijer & Taris, 2006). It has been argued that in modern society, characterized by anywhere, anytime connectedness to work, the lack of

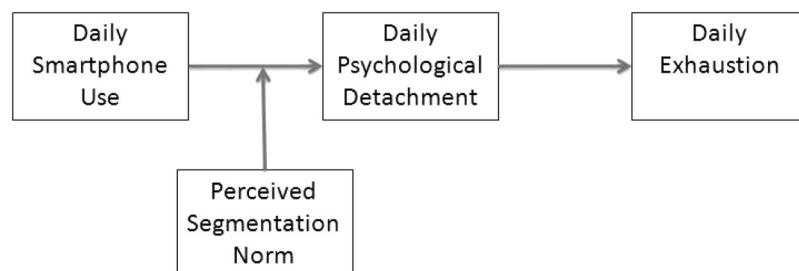


Figure 1. Research model.

psychological detachment could have even more impact on an individual's mental health than strain itself (Lundberg, 2005; Sonnentag & Zijlstra, 2006). Periods of rest from work are important in maintaining mental health at work (Eden, 2001) and result in a decrease in perceived job stress and burnout (Westman & Etzion, 2001). In our study, we operationalized mental health in terms of work-related exhaustion (cf. De Lange, Taris, Kompier, Houtman, & Bongers, 2004), a well-known core dimension of the burnout concept (Demerouti, Mostert, & Bakker, 2010; Maslach & Leiter, 1997; Maslach, Schaufeli, & Leiter, 2001). To gain insight into the extent to which daily levels of psychological detachment are associated with fluctuations in the level of work-related exhaustion, we use a repeated-measures diary method, measuring work-related exhaustion on a daily basis on four consecutive workdays.

Sonnentag, Kutler, and Fritz (2010) argue that psychologically detaching from work outside of work hours provides a temporary break from job demands, which in turn reduces work-related exhaustion. If an employee fails to detach oneself from work, work-related thoughts continue to drain resources, with work-related exhaustion as a potential outcome. Empirical evidence supports the notion that unwinding from work outside of work hours is negatively related to exhaustion and need for recovery (Sonnentag & Fritz, 2007). Additionally, Sonnentag and Fritz showed that of all recovery experiences, psychological detachment had the strongest negative relation with impaired well-being because it had the potential to decrease acute load reactions. In another study, Sonnentag, Mojza, Binnewies, and Scholl (2008) showed that psychological detachment throughout the workweek was negatively related to negative affect at the end of the week. We therefore expect a negative relation between daily psychological detachment and work-related exhaustion.

*Hypothesis 2a:* Daily psychological detachment will be negatively related to daily work-related exhaustion.

Sonnentag, Kutler, and Fritz (2010) examined whether psychological detachment partially mediated the relation between work-home boundaries (spatial and technical) and strains (exhaustion and need for recovery). The study group consisted of pastors, a profession in which professional demands often intrude in family lives. They expected that clear work-home boundaries would be positively related to psychological detachment and that psychological detachment in turn would be negatively related to strain reactions. They found no support for the expected relationship in their sample. One of the alternative explanations they provide is that the work-home boundary in this profession is probably not that severely impacted. Furthermore, Sonnentag et al. questioned whether their operationalization of the boundaries was relevant enough. They checked whether the pastors had the office within their private home and whether they had separate phone lines for work and private phone calls, but checking e-mails and using smartphones during evening hours may have a stronger impact on the work-home boundaries (Sonnentag et al., 2010). In line with this, Derkx et al. (2012) already showed that being connected to work in the evening hours through smartphones had consequences for the extent to which employees succeed in undertaking recovery experiences aimed at psychological detachment. That is, smartphone users had more difficulties to mentally switch off from work compared with nonusers. Based on these findings and the argu-

mentation of Sonnentag and colleagues, we expect that daily work-related smartphone use is related to employee work-related exhaustion, via the lack of psychological detachment. Note that we argue that the relation between work-related smartphone use and work-related exhaustion can be explained by the disability to switch off during evening hours. In other words, we propose an association facilitated by the lack of psychological detachment—a core dimension of recovery (Etzion et al., 1998).

*Hypothesis 2b:* The relationship between daily work-related smartphone use and daily work-related exhaustion will be mediated by daily psychological detachment.

## Perceived Segmentation Norm

Organizations differ in their norms regarding employee availability for work outside of work hours, typically referred to as *boundary-management norms*. Kreiner (2006) distinguished between segmentation norms, promoting clear work-home boundaries, and integration norms, promoting permeable work-home boundaries and continuous availability for work. The organizational climate and the social expectations of managers and peers define what boundary-management behaviors are normative and create perceived sanctions for an individual for behaving otherwise. Boundary-management norms have been demonstrated to affect important employee outcomes. In his study, for example, Kreiner demonstrated that employees in segmentation-oriented organizations experienced less work-home conflict than employees in integration-oriented organizations.

The use of communications technology such as the smartphone increases the permeability of work-home boundaries because these technologies provide additional ways to access individuals anywhere, anytime (e.g., Haddon & Silverstone, 2000; Valcour & Hunter, 2005). Indeed, previous cross-sectional studies have shown that smartphone use is associated with norms that individuals should be available to others at any time, any place (Green, 2001); that mobile devices blur the distinctions between public and private domains of life (Green, 2002); and, that smartphone users experience work intensification and an inability to separate and keep distance from work (Jarvenpaa & Lang, 2005). Madden and Jones (2008) conducted a survey study using a large sample of U.S. workers of which 62% identified themselves as networked workers possessing technical devices like cell phones, smartphones, or similar devices. Forty-nine percent of this group indicated that the use of these technological tools increased their level of stress as it was made difficult to separate themselves from their work duties while at home. Altogether, communication technologies (e.g., the smartphone) allow the boundaries between the work and home domain to blur, which in turn promotes work-life integration (Fenner & Renn, 2004). In conclusion, there are indications that work-related smartphone use is associated with permeable boundaries between work and private life, resulting in difficulties to separate from work and to mentally switch off.

In terms of organizational boundary-management norms, employees working in a segmentation-oriented organization where it is normal to separate work and home domains will typically not be used to dealing with work-related interruptions of their private life. When such employees are confronted with intensified work-related smartphone use, they will likely experience more difficul-

ties to psychologically detach from work compared with employees who are used to integration norms and practices. We, therefore, expect that especially those employees who perceive strong workplace segmentation norms, will show impaired psychological detachment on days with more intensive work-related smartphone use. For them, the intensive work-related smartphone use outside of work hours is inconsistent with common practice at their workplace. The fact that work intrudes in their private life by means of the smartphone is a new experience that they have not learned how to deal with properly. This might contribute to feelings of frustration, which makes it even more difficult to mentally switch off work.

For employees working at organizations with norms that promote integration rather than segmentation, permeable boundaries between work and nonwork are the standard. These employees are used to the spillover of work into their home domain and the smartphone might actually facilitate their way of life. As a consequence, we expect that their feeling of psychological detachment will not decrease as strongly on days that their work-related smartphone use intensifies in comparison with employees who are used to separating work and home domains. Altogether, we expect that work-related smartphone use outside of work hours obstructs psychological detachment and that this interfering influence is stronger to the extent that employees perceive their workplace norms as favoring segmentation.

*Hypothesis 3:* The perceived workplace segmentation norm will moderate the negative relation between work-related smartphone use and psychological detachment, such that the negative relation between work-related smartphone use and psychological detachment will be stronger for employees who perceive a high segmentation norm at their workplace.

## Method

### Procedure and Participants

The participants for this research were recruited from four different sources: a consulting firm working in the field of executive search, a strategic management consultancy, a large-scale energy company, and through personal contacts of the authors. All respondents were employed in Germany. The three companies are located in Germany and operate internationally, English being their main company language. As such, communication and questionnaires for this study were all in English. The employees participating in this survey are all in the possession of a smartphone for work purposes. All participants participated on a voluntary basis and did not receive any reward.

The potential participants were contacted directly or by contact persons via invitation e-mails with a request to participate in a diary study on the evaluation of their work. The data were collected via online questionnaires using a diary-study approach in which respondents filled out a survey on four consecutive work days. To obtain a complete 4-day data series for each respondent, respondents could enter the study either on Monday or on Tuesday. At the end of the afternoon on each study day, respondents received an e-mail with instructions and a link to the questionnaire. The instructions clearly asked respondents to fill out the questionnaire at the end of their evening, just before going to sleep. The

Day 1 questionnaire included the demographics and the trait variable of perceived segmentation norm, as well as the daily measures of smartphone use, psychological detachment, and exhaustion. The three subsequent questionnaires only included the daily measures. We matched the data over the 4 days using a personal code. In the Day 1 questionnaire, respondents constructed their own code based on their birth date and initials. In the subsequent questionnaires, respondents were requested to fill out their code and were provided with a reminder of how the code had been constructed.

In total, 70 employees participated, of which 46 participants (62.2%) filled out all four questionnaires on successive working days. This led to between 235 and 268 data points at the within-subject level. Participants were 63.5% ( $n = 47$ ) male and 23.0% ( $n = 17$ ) female. The gender of 10 (13.5%) participants was unknown. The mean age was 35.8 years ( $SD = 7.62$ ). Of the participants, 82.2% were full-time employed, 2.7% were part-time employed, and another 2.7% were self-employed. Nine (12.3%) participants did not indicate their employment type. Four participants only filled out the demographics questionnaire and none of the diaries. They were excluded from further analysis.

## Measures

*Daily smartphone use after working hours* was measured with the 4-item intensive smartphone-use scale by [Derkx and Bakker \(2012\)](#) adjusted for daily measures. All items were rated on a 5-point Likert scale ranging from 1 = *totally disagree* to 5 = *totally agree*. Participants were instructed to answer the questions just before going to sleep as an evaluation of their evening. Example items are: "When my smartphone blinked to indicate new messages, I could not resist checking them" and "Today, I was online until I went to sleep." Cronbach's alpha of the scale varied from .57 to .71, with an average of .63 over the 4 days.

*Daily psychological detachment from work* was measured with the psychological detachment subscale (four items) of the Recovery Experiences Questionnaire ([Sonnentag & Fritz, 2007](#)). All items were rated on a 5-point Likert scale (1 = *totally disagree*, 5 = *totally agree*). The scale was adjusted for daily measurement. Example items are: "In my free time after work I forgot about work today" and "In my free time after work I distanced myself from my work." Cronbach's alpha of the scale varied between .83 and .85 (average .84).

*Daily work-related exhaustion* was measured with 4-item of the subscale of the Maslach Burnout Inventory (MBI) as it was used by [Byrne \(1991\)](#) adjusted for daily measurement. Example items are: "I felt like I am at the end of my rope" and "I felt frustrated by my job today." All items were rated on a 5-point Likert scale (1 = *totally disagree*, 5 = *totally agree*). Cronbach's alpha varied between .74 and .88 (average .82).

*Perceived segmentation norm* was measured in the general background questionnaire, using the segmentation supply items of Kreiner's scale (2006). This scale includes four items that are rated on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). Example items are: "At my workplace, people are able to prevent work issues from creeping into their home life" and "Where I work, people can mentally leave work behind when they go home." Cronbach's alpha of this scale was .89.

*Daily workload* was measured as a control variable because high workload is potentially related to all model variables (smartphone

use, detachment, and exhaustion) and may act as confounding variable. It was measured with the 3-item scale developed by Bakker, Demerouti, Taris, Schaufeli, and Schreurs (2003), adjusted for daily measurement. The items are rated on a 5-point Likert scale (1 = *totally disagree*, 5 = *totally agree*). An example item is "I had to work extra hard to finish things today." Cronbach's alpha varied between .88 and .95 (average .91).

### Strategy of Analysis

Our repeated measures data can be viewed as multilevel data, with repeated measurements nested within individuals. This leads to a two-level model with the repeated measures (daily variables) at the first-level ( $N =$  between 235 and 268 study occasions) and the individual participants at the second level ( $N = 70$  participants). We used multilevel analysis with the MIwiN program (Rashbash, Browne, Healy, Cameron, & Charlton, 2000) to analyze our data. For the analyses regarding the first two hypotheses, predictor variables at the day-level (Level 1: daily work-related smartphone use and daily psychological detachment) were centered to the individual mean. Age and workload had significant correlations with some study variables and were therefore included in the analyses. However, the interaction results did not change after controlling for these two variables. Predictor variables at the trait level, in our case perceived segmentation norm, was centered around the grand mean (for a more detailed discussion on the centering of variables regarding cross-level effects see Aguinis, Gottfredson & Culpepper, 2013).

## Results

### Descriptive Statistics

Table 1 presents the means, standard deviations, and correlations among the study variables. In order to examine the proportion of variance that is attributed to the different levels of analysis, we calculated the intraclass correlation (*ICC*) for each day-level variable. Results showed that 43% of the variance in work-related smartphone use, 50% of the variance in psychological detachment, and 48% in work-related exhaustion was attributable to within-person variations, thus justifying our multilevel approach.

### Hypotheses Testing

According to Hypothesis 1 daily work-related smartphone use will be negatively related to daily psychological detachment. The

multilevel model that contained daily work-related smartphone use as the predictor of daily psychological detachment was compared with the null model that included only the intercept. The model containing smartphone use as a predictor, next to age and workload as control variables, showed a significant improvement over the null model ( $\Delta-2x \log = 31.68$ ,  $df = 1$ ,  $p < .001$ ). The estimate of smartphone use ( $\gamma = -.195$ ,  $SE = .086$ ,  $t = 2.27$ ,  $p < .025$ ), was significant and negative (see Table 2), supporting Hypothesis 1: On days that employees used their smartphones more intensively, they were less able to detach.

According to Hypothesis 2a, daily psychological detachment will be negatively related to daily work-related exhaustion. To test Hypothesis 2a, we examined two models for work-related exhaustion: a null (intercept-only) model and a predictor model in which both control variables (age and workload) and daily psychological detachment were added. Regarding the relation between psychological detachment and work-related exhaustion, results (see Table 3) showed that psychological detachment was significantly and negatively related to work-related exhaustion ( $\gamma = -.390$ ,  $SE = .065$ ,  $t = 6$ ,  $p < .001$ ). Furthermore, the predictor model showed a significant improvement in explained variance over the null model ( $\Delta-2x \log = 69.62$ ,  $df = 2$ ,  $p < .001$ ).

Hypothesis 2b stated that daily psychological detachment will mediate the relation between daily work-related smartphone use and daily work-related exhaustion. To test whether results indeed imply a mediation model, we first tested whether smartphone use and work-related exhaustion were directly related (Mathieu & Taylor, 2006). Results showed (see Table 3) that there is no significant direct relation between daily smartphone use and daily work-related exhaustion ( $\gamma = .04$ ,  $SE = .08$ ,  $t = 0.5$ ,  $p = ns$ ). Therefore Hypothesis 2b has to be rejected. However, like MacKinnon, Lockwood, Hoffman, West, and Sheets (2002) suggest, it is possible to test for an indirect effect when both the predictor-mediator and mediator-outcome paths are significant (see also Kenny, Kashy, & Bolger, 1998). Indirect effects are a special form of intervening effects where the predictor and outcome variable are not related directly, but they are indirectly related through significant relationships with a linking mechanism (Mathieu, & Taylor, 2006). Therefore, we decided to conduct a post hoc test to find out whether work-related smartphone use is indirectly related to work-related exhaustion via daily psychological detachment. Our results already established the significant relationships between work-related smartphone use and psychological detachment (Hypothesis 1) and between psychological detachment and work-related exhaustion (Hypothesis 2a). Because both smartphone use (independ-

Table 1  
Means, Standard Deviations and Correlations for all Study Variables

	Mean	Std.	1	2	3	4	5	6
1. Gender (0 = male, 1 = female)	0.73	0.47						
2. Age	35.76	7.62	.02					
3. Workload	2.46	1.22	-.07	-.04				
4. Smartphone use	3.38	0.72	-.01	-.06	.31**			
5. Psychological detachment	2.85	0.74	.12	.02	-.22**	-.33**		
6. Work-related exhaustion	2.16	0.73	-.12	-.15*	.36**	.34**	-.40**	
7. Segmentation	3.25	1.35	-.14*	-.09	-.01	-.38**	.26**	-.27**

Note. Correlations between daily variables are based on averaged scores across the four days that the study took place;  $n = 70$ .

\*  $p < .05$ . \*\*  $p < .01$ .

Table 2

*Multilevel Results of the Link Between Daily Work-Related Smartphone Use and Daily Psychological Detachment*

	Psychological detachment			
	Null model		Predictor model	
	Estimate	Std. er.	Estimate	Std. er.
Intercept	2.832**	0.074	2.854**	0.073
Age		0.003	0.010	
Workload		-0.108*	0.061	
Smartphone use		-0.195*	0.086	
Variance level 2 (employee)	0.279 (50%)	0.062	0.261	0.060
Variance level 1 (day)	0.283 (50%)	0.030	0.271	0.029
-2 Log likelihood	483.493		451.818	

Note. Data points = 240 of 268 cases in use (respondents  $n = 70$ , days  $n = 4$ ).

\*  $p < .05$ . \*\*  $p < .001$ .

dent variable) and work-related exhaustion (dependent variable) were significantly related to psychological detachment (intervening variable), we performed a Sobel test (Sobel, 1982) to see whether the indirect effect is significant (see Table 2 and 3 for input for the Sobel test). Results from the Sobel test support the indirect link between smartphone use and work-related exhaustion via psychological detachment ( $z = 2.11$ ,  $p < .05$ ).

Hypothesis 3 stated that the perceived workplace segmentation norm, shortly referred to as segmentation, will moderate the relation between daily work-related smartphone use and daily psychological detachment. We expected that employees who perceive a high segmentation norm at their workplace would experience a stronger decrease in psychological detachment on days that they use their smartphone intensively than employees who perceive a low segmentation norm. Table 4 shows the significant multilevel interaction between workplace segmentation and daily smartphone use in relation to experienced daily psychological detachment. Again, we controlled for age and workload. Segmentation significantly moderated the relationship between daily work-related smartphone use and daily psychological detachment ( $\gamma = -.264$ ,  $SE = .154$ ,  $t = 1.71$ ,  $p < .05$ ). Furthermore, the interaction model

Table 4

*Multilevel Results of the Interaction of Perceived Segmentation Norm and Daily Work-Related Smartphone Use on Experienced Daily Psychological Detachment*

	Psychological Detachment			
	Null model		Interaction model	
	Estimate	Std. er.	Estimate	Std. er.
Intercept	-0.000	0.098	0.015	0.089
Age			0.005	0.012
Workload			-0.140	0.080
Segmentation			0.480**	0.151
Smartphone use			-0.033	0.123
Segmentation × Smartphone use			-0.264*	0.154
Variance Level 2 (employee)	0.499 (50%)	0.112	0.348	0.088
Variance Level 1 (day)	0.507 (50%)	0.054	0.493	0.053
-2 Log likelihood	625.036		576.854	

Note. Data points = 243 of 268 cases in use (respondents  $n = 70$ , days  $n = 4$ ).

\*  $p < .05$ . \*\*  $p < .001$ .

showed a significant improvement in explained variance over the null model ( $\Delta -2x \log = 48.182$ ,  $df = 5$ ,  $p < .001$ ).

Figure 2 shows the interaction plot, indicating that employees who perceive strong workplace segmentation norms show a strong decrease in psychological detachment on days that they use their smartphone more intensively. On the other hand, employees who perceive a low segmentation norm experience an increase in psychological detachment when they use their smartphone more intensively. To examine the interaction patterns in more detail, we conducted simple slope tests using the online tool suggested by Preacher, Curran, and Bauer (2006). We used the Johnson-Neyman (Johnson & Neyman, 1936) technique to calculate the regions of significance resulting in upper and lower boundaries representing the range within the simple slope of  $y$  on  $x$  is significant from zero. Simple slopes outside the region are significant at the set significance level. The multilevel interaction between daily smartphone use and perceived segmentation norm in relation to experienced daily psychological detachment was significant. There

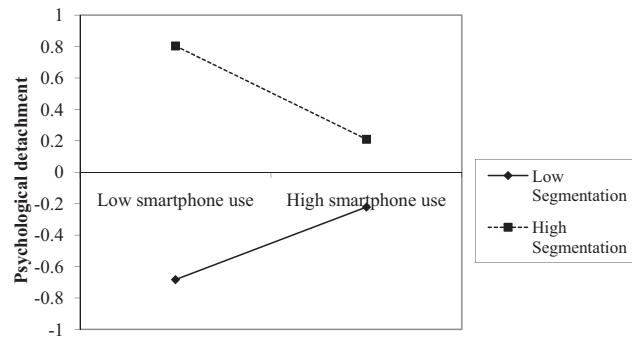
Table 3

*Multilevel Results of the Links Between Daily Work-Related Smartphone Use, Daily Psychological Detachment, and Work-Related Exhaustion*

	Work-related exhaustion							
	Null model		Predictor model 1		Predictor model 2		Predictor model 3	
	Estimate	Std. er.	Estimate	Std. er.	Estimate	Std. er.	Estimate	Std. er.
Intercept	2.175***	0.073	2.184***	0.074	1.980***	0.366	1.671***	0.405
Age			-0.015	0.010	-0.014	0.009	-0.013	0.009
Workload			0.232***	0.058	0.214***	0.045	0.202***	0.046
Smartphone use			0.040	0.081			0.098	0.063
Psychological Detachment					-0.390***	0.065	-0.376***	0.066
Variance Level 2 (employee)	0.277 (52%)	0.062	0.282	0.063	0.248	0.054	0.224	0.050
Variance Level 1 (day)	0.260 (48%)	0.028	0.241	0.026	0.198	0.021	0.201	0.022
-2 Log likelihood	513.065		434.436		391.619		389.466	

Note. Data points = 240 of 268 cases in use (respondents  $n = 70$ , days  $n = 4$ ).

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .



**Figure 2.** Moderation of perceived segmentation norm (segmentation) on the relationship between daily work-related smartphone use and daily psychological detachment.

was a trend in our data pointing at the proposed direction. However, the tested relation between smartphone use and psychological detachment was not significantly more negative for employees who perceive a high segmentation norm at their workplace ( $\beta = -.418$ ,  $SE = .24$ ;  $CI = 1.318, -.342$ ). The observed  $\beta$  value was just outside the confidence interval ( $\alpha = .10$ ) indicating a nonsignificant effect ( $z = 1.65$ ,  $p = .10$ ). For employees who perceive a norm in favor of integrating work with home (low segmentation), the simple slope was within the region boundaries ( $\beta = .312$ ,  $SE = .24$ ,  $p = ns$ ), indicating that for these employees, smartphone use and psychological detachment were not significantly related. In all, however, these results were not strong enough to support Hypothesis 3.

### Additional Analysis

The technique of mediated moderation effects as suggested by Mathieu and Taylor (2006) allows a test of complete research model. In their technique, the proposed interaction term is used when testing the relation between the independent variable and the mediator rather than the single independent variable. In our case, this implies regressing daily psychological detachment on the interaction between daily smartphone use and segmentation. As reported above, this relation was supported ( $\gamma = -.264$ ,  $SE = .154$ ,  $t = 1.71$ ,  $p < .05$ ). The relation between psychological detachment and exhaustion was also significant ( $\gamma = -.376$ ,  $SE = .066$ ,  $t = 5.70$ ,  $p < .001$ ). Results from the one-sided Sobel test point in the direction of the proposed mediation moderation effect ( $z = 1.64$ ,  $p < .05$ ).

### Discussion

Technological innovations have resulted in an increase of non-standard work schedules, including evening, night, and weekend work (Härmä, 2006). Today, millions of employees use electronic tools (e.g., the smartphone) to do their jobs away from the traditional office (Hill, Ferris, & Martinson, 2003). However, the consequences of ubiquitous computing and its' associated 24/7 availability for work are still under researched. Therefore, the central aim of this article was to examine the association between intensive work-related smartphone use and psychological detachment and work-related exhaustion. In addition, because work-

related smartphone use is frequently associated with blurred boundaries between the work and home domain (e.g., Galinsky, Kim, & Bond, 2001; O'Mahony & Barley, 1999), we examined whether the perceived segmentation norm at the workplace would influence the relation between work-related smartphone use and psychological detachment. We conducted a diary study that captured daily fluctuations in work-related smartphone use, psychological detachment, and work-related exhaustion. A fundamental benefit of a diary study is that the amount of time elapsed between an experience and the account of the experience is minimized (Bolger, Davis, & Rafaeli, 2003), resulting in more accurate observations. Additionally, the explained variance on the day level was high in our sample, which adds to our argument that daily measurements are justified and supports our assumption that these variables fluctuate from day to day.

In line with our expectations, our results showed that intensive work-related smartphone use was negatively related to psychological detachment. This is congruent with Sonnentag and Kruel's (2006) assumption that making work-related phone calls in the evening will make psychological detachment very difficult. In addition, Derk et al. (2012) previously showed that smartphone users had a hard time initiating activities aimed at psychological detachment in response to strong work-home interference.

The association between psychological detachment and employee well-being is well established. Earlier studies showed that psychological detachment is related to less fatigue and better mood (Sonnentag & Bayer, 2005), less exhaustion (Sonnentag, Kutler, & Fritz, 2010), and less negative affect (Sonnentag et al., 2008). Our results show that smartphone users are no exception to the rule, replicating the negative relation between psychological detachment and work-related exhaustion.

The mediation hypothesis indicating that daily work-related smartphone use would be related to daily work-related exhaustion via daily psychological detachment had to be rejected because there was no direct relation between smartphone use and work-related exhaustion. However, post hoc tests show that both work-related smartphone use and work-related exhaustion are meaningfully related to psychological detachment, which is an important contribution of this study. More specifically, work-related smartphone use obstructs psychological detachment, and this lack of detachment is related to higher levels of work-related exhaustion. To our knowledge there are no other studies that examined this relationship, although it has been suggested before that it might be difficult for smartphone users to distance oneself from work on a daily basis (e.g., Derk & Bakker, 2012; Derk, ten Brummelhuis, Zecic, & Bakker 2012; Siltaloppi, Kinnunen, & Feldt, 2009). In this study we find empirical evidence that work-related smartphone use can inhibit psychological detachment, which in turn, is related to an increase in feelings of work-related exhaustion.

In the final hypothesis, we argued that daily work-related smartphone use and daily psychological detachment would be more strongly negatively related for employees who perceived a high segmentation norm at their workplace in comparison with employees working at organizations where it is normal to integrate work and private life (low perceived segmentation norm). Simple slope tests showed that the suggested interaction was not significant at the .05 level. However, the multilevel interaction coefficient was significant pointing at a negative relationship between work-related smartphone use and psychological detachment for employ-

ees high on segmentation. Taken together, we can only tentatively suggest that employees who perceive a high segmentation norm, experience less psychological detachment on days that they use their smartphone more intensively. This probably occurs because the smartphone brings their work into the home domain, and they were not used to that. However, a larger sample in a future study is necessary to solve this issue of inconclusive results. Park et al. (2011) did show a similar, though more convincingly significant, pattern in a survey study: Technology use at home partially mediated the positive relationship between the perceived segmentation norm and the experience of psychological detachment. A multilevel study can contribute to these findings in showing a cross-level interaction between the more stable variable of perceived segmentation norm and the daily fluctuations in both smartphone use and psychological detachment. Although we have to be careful in interpreting trends in data, in our view our findings do provide some first insight into how the day-to-day relation between smartphone use and psychological detachment could be affected by the perceived segmentation norm at the workplace. However, for employees who perceive a high norm to integrate (low on segmentation), the relation between work-related smartphone use and psychological detachment was not significant, probably due to limited power in the analyses. These preliminary findings might contribute to prior research, which has already shown that employees' use of communication technology is strongly influenced by organizational culture (Fulk, Schmitz, & Schwarz, 1992; Markus, 1994; Orlikowski, 1992, 2000).

Additionally, the interaction pattern shows some other interesting trends that are open to alternative explanations. One such trend is the notably lower level of detachment at low levels of smartphone use for employees with low as compared with high segmentation norms. A possible explanation could be that on days when employees who perceive a low segmentation norm report low smartphone use, other obligations or activities might be keeping them from working at home although in fact they would prefer to be working (i.e., home-work interference). This may yield frustration, preoccupation with unfinished work and a resulting lack of psychological detachment. As such, for this group not being able to attend to work matters while at work may actually be unnerving. Employees perceiving high segmentation norms, on the other hand, are by definition inclined to separate themselves from work in their private time and will detach from work relatively easily at days with low work-related smartphone use. Another trend is the generally lower level of detachment displayed by employees with a low segmentation norm as compared with employees with a high segmentation norm. This trend reflects the main effect of perceived segmentation norms on psychological detachment: the higher the level of perceived workplace segmentation, the lower the level of detachment. The combination of these two trends suggests an intriguing arena for further research: in general, employees who perceive a low segmentation norm show relatively low psychological detachment. Preventing them from working at home, for example, by lowering their work-related smartphone, however, would appear to have adverse effects, resulting in even lower detachment levels. It would be very interesting to study this group in more detail.

Finally, by using the technique of mediated moderation (Mathieu & Taylor, 2006) we tested our complete research model. The

results show a small, but significant, effect providing evidence for our proposed model.

## Limitations and Future Research

Most studies have several limitations; unfortunately this study is no exception. First, it should be noted that the reported findings were all synchronous effects. We conducted multilevel analyses using diary data, but the temporal order of the variables could not be established within our design. All our daily variables were collected at the same time: at the end of the day. Therefore, it is important that future studies establish the temporal order of the model variables by assessing the variables at different points in time during the day. One issue that could be a useful contribution to the field is to examine the causal relation between work-related smartphone use and psychological detachment in the evening, and its consequences for work-related exhaustion the next working day. Then, it becomes clear whether work-related smartphone use and psychological detachment are antecedents of work-related exhaustion. One suggestion would be to measure sleep quality and energy levels in the morning, to address the possible confounding influence of these concepts on exhaustion at the end of the working day. In addition, a longitudinal quasi-experimental design with zero-history groups on work-related smartphone use would be very interesting. Such a design would allow assessment of the consequences of work-related smartphone use in terms of performance and well-being on the long run, in comparison to a control group. A point related to the temporal aspects of the measurement is the work-related character of the exhaustion scale. We used the items of the scale that were not temporally associated with the end of the workday and instructed respondents to report their level of exhaustion at the moment they filled out the questionnaire just before going to sleep. However, as already stated, for future studies it is necessary to temporally separate between measures of exhaustion and psychological detachment. Additionally, next to work-related measures of well-being, more general measures of well-being should be included.

Second, when interpreting our results for work-related smartphone use, three issues should be taken into account. First, we did not include overall time dedicated to work at home, besides work-related smartphone use, in our model. It is possible that employees spent time on work-related activities other than smartphone use, which may have additional implications for detachment and work-related exhaustion. Next, our scale for work-related smartphone use showed relatively low reliability. To cover the full breadth of the construct, the items do tap into slightly different aspects of smartphone use (e.g., not being able to resist checking new messages, being online continuously). Possibly, this approach enhances the risk of relatively low scale reliability, even though a previous study did report a satisfactory alpha for the same scale (Derkx & Bakker, 2012). The reliability issue may have yielded slightly decreased statistical power, thus attenuating our results for smartphone use (cf. Lance, Butts, & Michels, 2006). Additional research is needed to learn whether this issue reflects an incident or a more persistent characteristic of the work-related smartphone-use scale. Finally, the work-related smartphone-use scale reflects the perceived intensity of smartphone use. Although this is a relevant indicator with demonstrable influence on various important employee outcomes (Derkx & Bakker, 2012) it provides no

detailed information about the exact nature or duration of respondents' work-related smartphone use outside of work ours. Future studies might consider assessing, for example, the total time spent on work-related smartphone use outside of work hours, how many messages a respondent received during an evening and how many of these were answered, or the type of messages employees sent during evening hours. More detailed information on such aspects of work-related smartphone use could contribute to theory development on the consequences of work-related smartphone use outside of work hours and yield more refined guidelines for organizational practice.

Third, in this study we examined perceived segmentation norm at the workplace to get an idea of the perceived norms regarding availability. We collected data at different organizations with probably different norms regarding contacting colleagues for work-related issues in the evening hours. Unfortunately, confidentiality agreements prevented us from registering data on organizational membership. As a result, we were unable to trace respondents back to their organization and had no means of controlling for organizational membership.

Future studies should consider adding variables on the organizational level to their research design. Additionally, many studies on availability and boundary management consider boundary management as a strategy of the employee, which might be the other side of the story. In future research it would be very interesting to explore whether the (mis)fit between the boundary management strategy of the employee and the expectations of the employer is critical for the impact of work-related smartphone use. The results of the current study suggest that especially employees that worked at a company that allows them to separate but who find themselves prompted to integrate by the availability of a smartphone, experience a lack of psychological detachment. Next to boundary management strategy, which is considered a trait-like variable, it might also be interesting to include other personality characteristics. For instance, people high on neuroticism might experience workload and exhaustion different from people high on emotional stability. Or, how conscientious people are might affect their perception of segmentation. A final suggestion for future research would be to more closely examine personal characteristics of employees that might account for between person differences. For example, some employees might have higher levels of energy to begin with, and therefore they might be less easily exhausted than employees who have lower levels of energy in general.

## Implications for Practice

As we had already noticed, work-related smartphone use is still increasing both in the organizational context and the private domain. Apart from the contribution to theory development, our findings therefore have important practical implications. We found strong evidence that work-related smartphone use is related to difficulties with psychological detachment from work. Furthermore, this lack of detachment coincided with increased work-related exhaustion. For that reason, it is important for employees as well as employers to take their responsibility. The negative relation between work-related exhaustion and job performance is well established (e.g., Leiter, Harvey, & Frizzell, 1998; Vahey, Aiken, Sloane, Clarke, & Vargas, 2004; Wright & Cropanzano, 1998). Employees who are exhausted cannot function at the best of their

capabilities. As a result, both the organization and the employee are victimized. Employers should be careful in creating expectations regarding availability when they decide to provide smartphones to their employees. One way to deal with this is to be transparent about what is expected and to make employees aware of the potential pitfalls of work-related smartphone use.

There are examples in the popular press of discussions on smartphone use and mobile e-mail, tying employees to their jobs, leaving little room to disengage (e.g., Robinson, 2006; Zambowicz, 1998). Our results indeed link work-related smartphone use to difficulties to psychologically detach from work outside of work hours. Moreno-Jiménez et al. (2009) suggest that organizations can help employees by developing programs that facilitate psychological detachment.

The smartphone users in our sample differed in how they perceived the segmentation norm at their workplace. We showed that especially employees who feel that they normally can mentally leave their work behind at their workplace (high on segmentation) have difficulties to psychologically detach themselves on days that they use their smartphone intensively. It is not clear whether this was the intention of the employer when providing the smartphone. Perhaps employees felt compelled to stay connected to work by their smartphone without the employer being aware of the norms regarding work-related smartphone use during leisure time. The employee's health is in the interest of both the employer and the employee. Therefore, we would recommend them to be transparent about their expectations regarding availability issues in order to benefit from the advantages in increased mobility as much as possible.

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